

Chandeleur Islands Barrier System

The Chandeleur Islands barrier system lies about 25 km north-northeast of the mouth of the Mississippi River and about 120 km east of New Orleans (fig. 1). This system extends south to north from Breton Island to Hewes Point (chapter 1, fig. 18). The Chandeleur Islands are the largest barrier island system along the Mississippi River delta plain and provide the seaward protective boundary for St. Bernard Parish (Kwon, 1969; Kahn, 1980; Nummedal and others, 1980; Kahn and Roberts, 1982; Penland and others, 1985; Suter and others, 1988; Ritchie and others, 1991). Three tidal inlets, Breton Island Pass, Grand Gosier Pass, and Curlew Island Pass, connect the Gulf of Mexico to Breton and Chandeleur sounds. For the purposes of this atlas, the Chandeleur Islands barrier system is divided into two sections: South Chandeleur Islands (Breton, Grand Gosier, and Curlew islands) and North Chandeleur Islands (New Harbor, North, and Freemason islands, and Chandeleur Island). The South Chandeleur Islands extend north from Breton Island to Curlew Island, and the North Chandeleur Islands extend from Curlew Island Pass to Hewes Point. Shoreline position, island width, and rate of change data were compiled for the South Chandeleur Islands from the years 1869, 1922, 1951, 1978, and 1989; the North Chandeleur Islands include the years 1855, 1922, 1951, 1978, and 1989.

South Chandeleur Islands-1869 to 1989

Morphology

The South Chandeleur Islands are fragmented into three groups of small ephemeral islands and shallow shoals that are separated by wide tidal inlets. In 1869, the barrier islands included Breton Island, Errol Island, and Curlew Island (1869 map). Grand Gosier, which currently lies between Breton Island and Curlew Island, was not mapped on the NOS T-sheet for this area. Either field surveyors accidentally missed the island, or the island did not exist at that time. Breton Island displayed a typical horseshoe shape that characterizes the island today, which suggests antecedent topographic control that anchors both ends. By 1922, all of the islands except Breton were reduced to small islands and shoals (1922 map). Additionally, Breton Island was breached, and two small shoals appeared between Breton and Errol islands. These features later corresponded to the north and south ends of Grand Gosier Island.

By 1951, Grand Gosier had evolved into a substantial barrier island apparently from two much smaller shoals (1951 map). Also, Errol Island was not present, leaving Curlew Island and the southern half of Stake Island to the north. The 1978 map depicts Breton and Grand Gosier islands as breached. The resistant ends of Breton Island are evident and tend to anchor the island. Grand Gosier Island evolved into two smaller islands known as north and south Grand Gosier islands, and Curlew Island was the single remaining barrier island to the north. By 1989, these three groups of islands had remained relatively intact (1989 map). The central portion of Breton Island remained susceptible to breaching, and the northern end of south Grand Gosier formed a unique recurved spit directed offshore. A large fetch is available across Breton and Chandeleur sounds capable of producing enough wave energy to form well-developed, barred beaches along the bay shorelines of south and north Grand Gosier islands and Curlew Island. On the northern end of south Grand Gosier, bayside wave energy may be more dominant than gulfside wave energy, thus producing the recurved spit.

Shoreline Movement

Shoreline change maps were constructed for the South Chandeleur Islands area. Shoreline movement and island width were derived from 120 shore-normal transects along the gulf and bay shorelines (transects map, tables 31, 32, 33, 34, and 35). Comparisons of shoreline position are made for the periods 1869 vs. 1922, 1922 vs. 1951, 1951 vs. 1978, 1978 vs. 1989, and 1869 vs. 1989.

The average rate of gulfside change for the South Chandeleur Islands between 1869 and 1922 was -11.3 m/yr (fig. 47, table 35). This rate decreased twofold to -5.7 m/yr between 1922 and 1951. Between 1951 and 1978, the rate increased to -16.6 m/yr and increased further to -19.7 m/yr between 1978 and 1989. Along the bay shoreline, the average rate of change was 8.8 m/yr between 1869 and 1922 and decreased to 5.9 m/yr between 1922 and 1951 (fig. 48, table 33). The rate increased to 9.8 and 19.8 m/yr for the periods 1951 to 1978 and 1978 to 1989, respectively. The South Chandeleur Islands are migrating landward along the gulf and bay shorelines because a good sediment supply exists, and the islands are narrow and low enough for this sediment to be transported across the island by washover processes.

The 1869 vs. 1989 map illustrates land loss and summarizes changes along the gulf and bay shorelines. Between 1869 and 1989, the average rate of change along the gulf shoreline ranged from 5.9 to -21.1 m/yr with an average rate of -11.6 m/yr (table 35). The gulf shoreline of the South Chandeleur Islands has undergone retreat over the last 120 years, except for the southern end of Breton Island, which experienced accretion. The bay-side rate of change ranged from 22.6 to -7.7 m/yr, with an average rate of 10.7 m/yr (table 33). The gulf shoreline is migrating landward about 1.0 m/yr faster than the bay shoreline (-11.6 m/yr vs. 10.7 m/yr), causing the barrier width to narrow as the islands retreat (fig. 49, table 34).

Area and Width Change

Breton Island

In 1869, the average width of Breton Island was 396 m, and the area was 332 ha (tables 34, and 36). This area decreased by 18 percent to 271 ha over the next 53 years, with a similar decrease in width to 320 m. The average rate of change between 1869 and 1922 was -1.2 ha/yr. However, by 1951, island area expanded to 291 ha at a rate of 0.7 ha/yr, but island width continued to narrow (292 m).

During the period 1951 to 1978, Breton Island experienced the greatest amount of area loss. Island area was reduced by 52 percent, with a loss of 150 ha at a rate of 5.4 ha/yr, and the average island width narrowed to 268 m. Because its center area was breached, the island lost its unconsolidated and highly mobile central portion to leave two resistant ends that did not experience much change. Between 1978 and 1989, Breton Island slowly recovered and actually experienced a 23-ha increase in area to 164 ha, reversing from land loss to land gain at a rate of 2.2 ha/yr. Interestingly, average width continued to decrease (199 m) even though area was increasing. This was possible because the breached central portion of Breton Island almost completely recovered to cause area gain. Average island width did not increase, however, because the recovered central portion had always been narrower than the resistant ends. Therefore, when the resistant ends suffered concurrent erosion, an overall decrease in width occurred.

Breton Island's area decreased between 1869 and 1989 from 332 to 164 ha (fig. 50, table 36). The average rates of area change fluctuated between -5.4 and 2.2 ha/yr, which indicate reversing periods between land loss and gain in response to the breaching and healing process along the central island portion (fig. 51). In contrast, the average width of Breton Island experienced a continuous decrease from 1869 to 1989 (fig. 52).

Grand Gosier and Curlew Islands

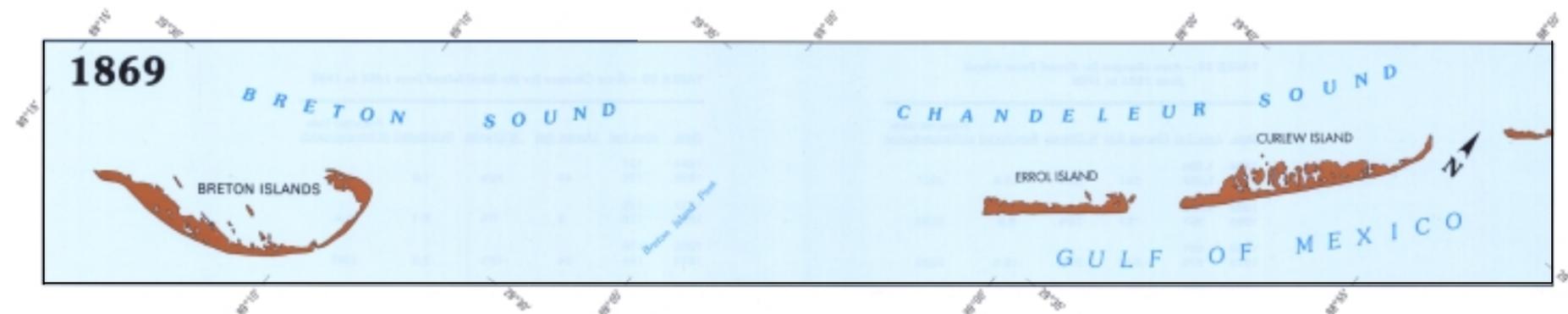
These barrier islands experienced extreme changes in configuration over the last 120 years, causing large fluctuations in average width and island area. In 1869, the average width was 423 m, and the area of Grand Gosier and Curlew islands was 453 ha (tables 34 and 37). By 1922, island area decreased dramatically to only 29 ha at an average rate of -8.0 ha/yr, and average island width was only 90 m (fig. 53). Tremendous land gain occurred by 1951 with island area expanding to 330 ha, a 1,038 percent increase at a rate of 10.4 ha/yr. Similarly, average width jumped 186 m to 276 m. Between 1951 and 1978, total area fell to 162 ha at a rate of 6.0 ha/yr. Changes in land area reversed again between 1978 and 1989, increasing 71 percent to 277 ha with a similar increase in island width to 249 m. For this period, Grand Gosier and Curlew islands experienced land gain at an average rate of 11.1 ha/yr.

Overall, the area of the islands declined between 1869 and 1989 from 453 to 277 ha (fig. 54). This is a total land loss of 39 percent at an average rate of -1.5 ha/yr (table 37). The rate of area change fluctuated between -8.0 to 11.1 ha/yr from 1869 to 1989, resulting in periods of land gain and loss similar to that of Breton Island (fig. 51). Likewise, average barrier width decreased from 423 m in 1869 to 249 m in 1989 (fig. 55). This signifies an average island narrowing rate of 1.5 m/yr between 1869 and 1989.

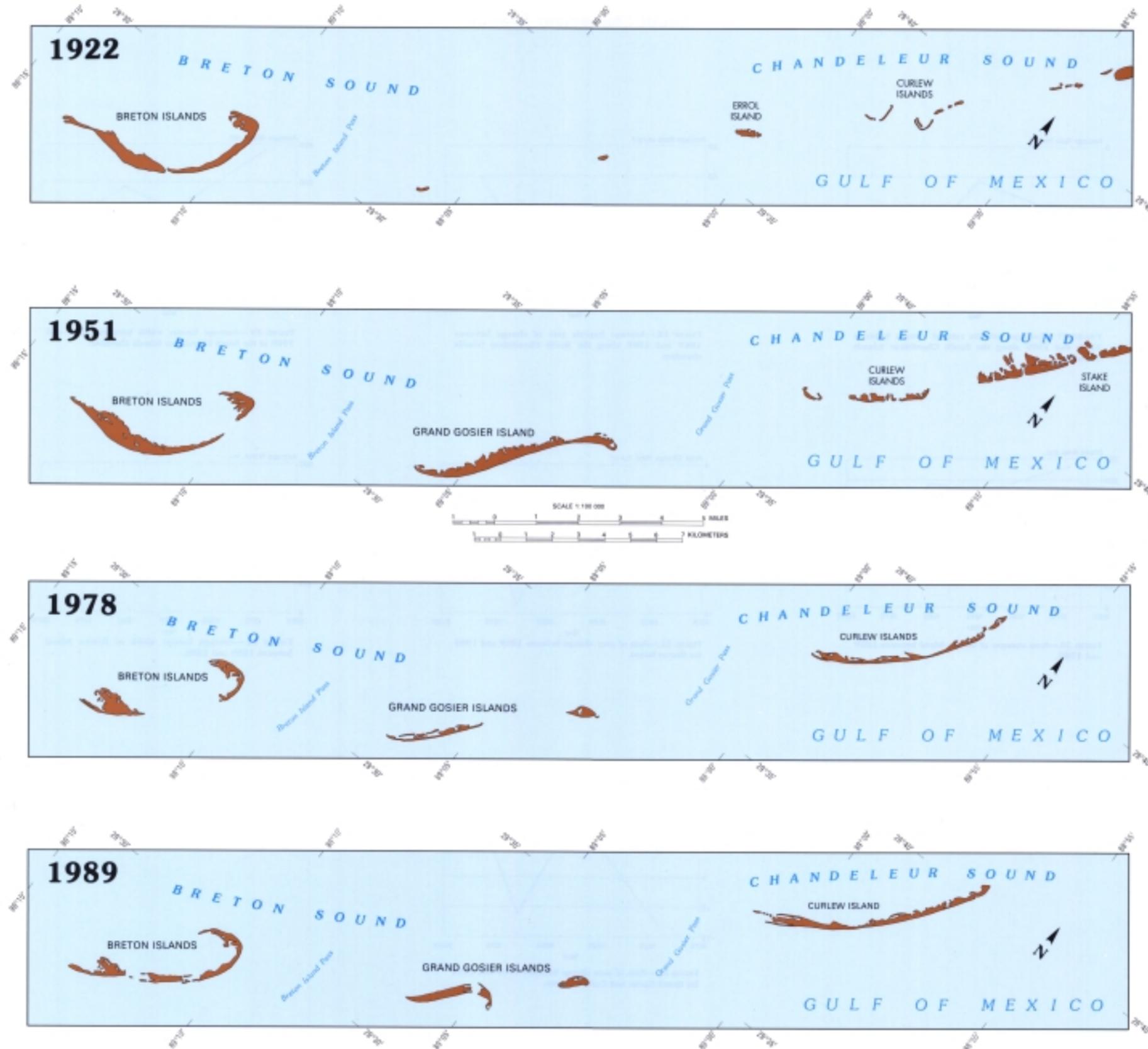
South Chandeleur Islands Summary

The area of the South Chandeleur Islands has shown an overall decline in area from 784 ha in 1869 to 441 ha in 1989 with fluctuations in the intervening years (fig. 56). A total loss of 343 ha, at an average loss rate of -2.9 ha/yr, has been determined (table 38). Interestingly, the average rate of area change fluctuated between -11.5 and 13.3 ha/yr from 1869 to 1989, showing cyclic periods of land gain during an overall trend of land loss (fig. 57). The barriers decreased in average width from 384 m in 1869 to 232 m in 1989. A comparison of barrier widths for 1869 and 1989 is shown in figure 58.

• Historic Shorelines •



South Chandeleur Islands



South Chandeleur Islands

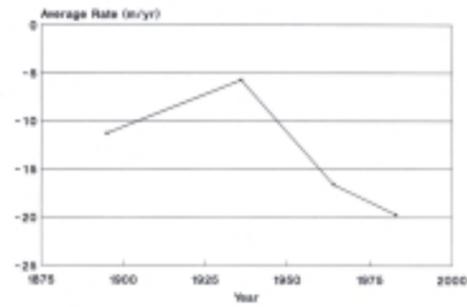


FIGURE 47.—Average gulfside rate of change between 1869 and 1989 along the South Chandeleur Islands shoreline.

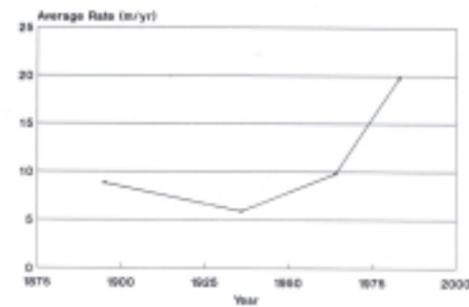


FIGURE 48.—Average bayside rate of change between 1869 and 1989 along the South Chandeleur Islands shoreline.

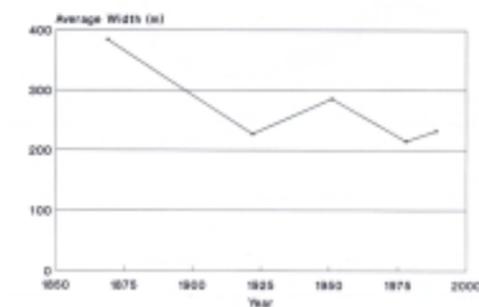


FIGURE 49.—Average barrier width between 1869 and 1989 of the South Chandeleur Islands shoreline.

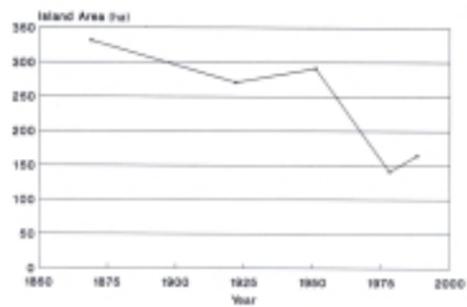


FIGURE 50.—Area changes of Breton Island between 1869 and 1989.

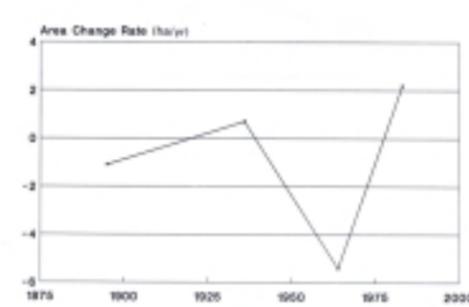


FIGURE 51.—Rate of area change between 1869 and 1989 for Breton Island.

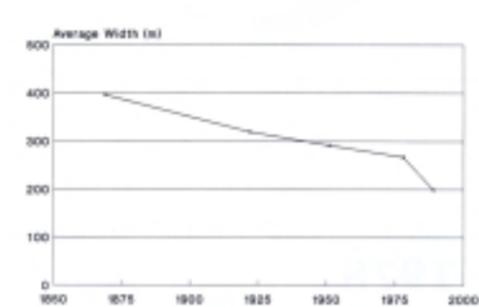


FIGURE 52.—Average barrier width of Breton Island between 1869 and 1989.

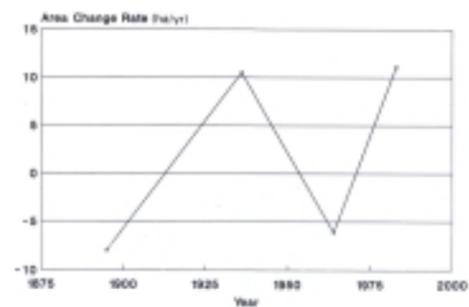
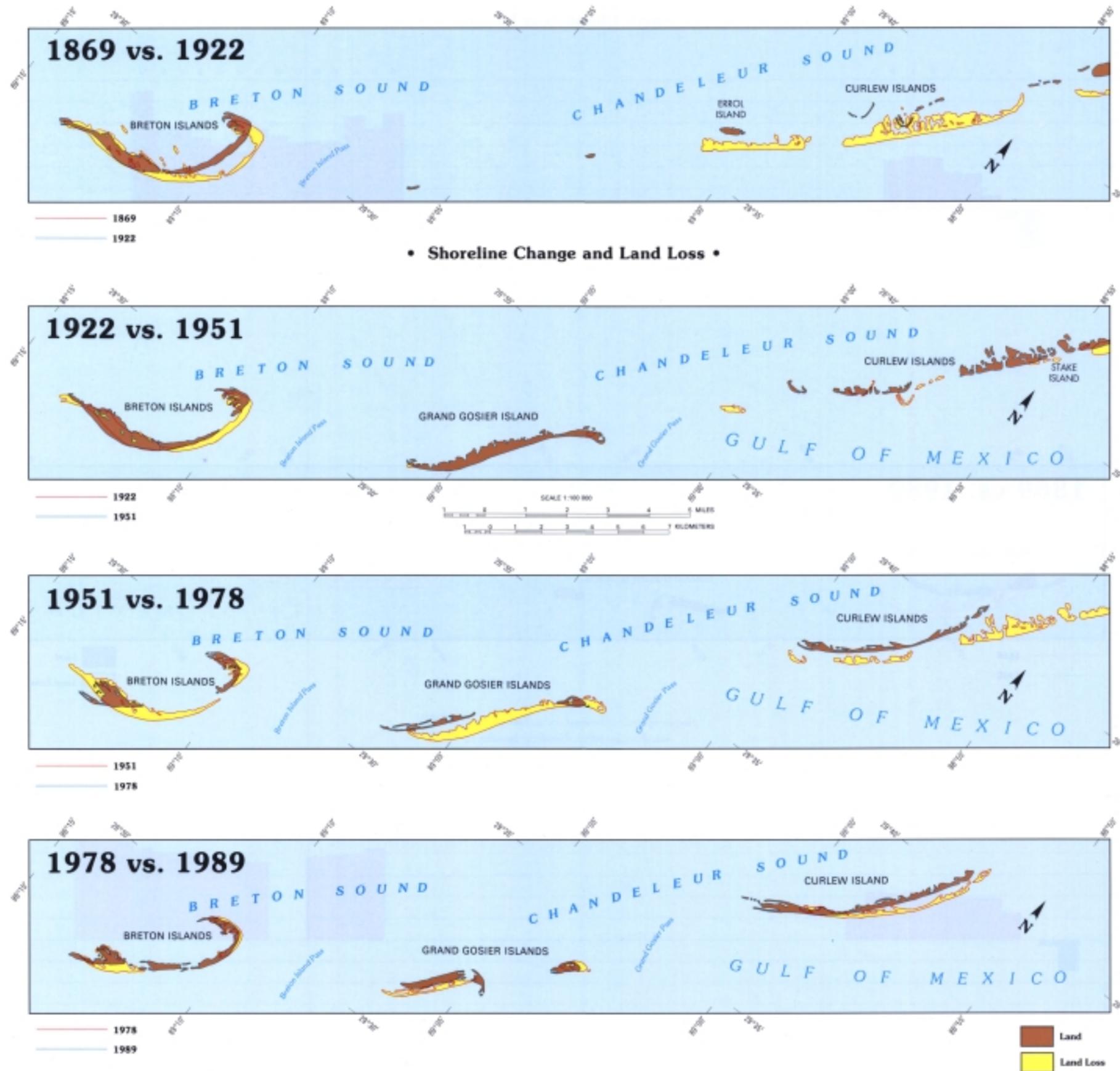
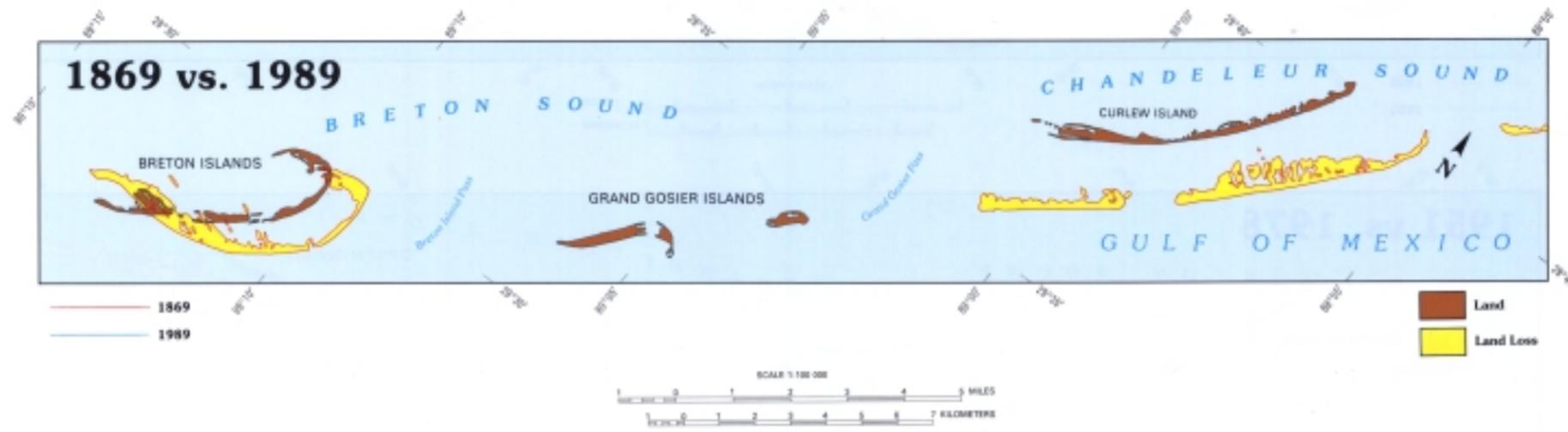


FIGURE 53.—Rate of area change between 1869 and 1989 for Grand Gosier and Carlew Islands.

South Chandealeur Islands



South Chandeaur Islands



South Chandeleur Islands

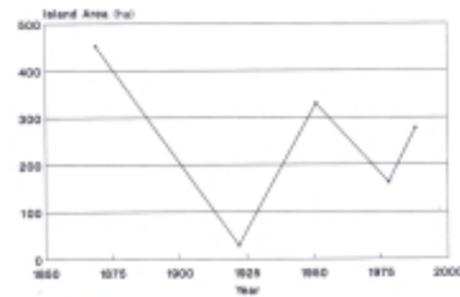


FIGURE 54.—Area changes of Grand Gosier and Curlew islands between 1869 and 1989.

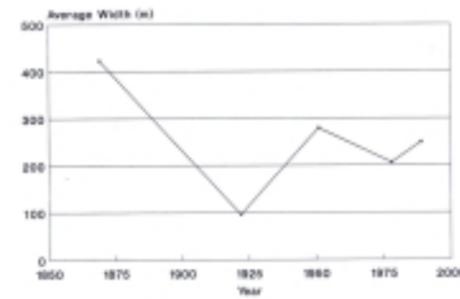


FIGURE 55.—Average barrier width of Grand Gosier and Curlew islands between 1869 and 1989.

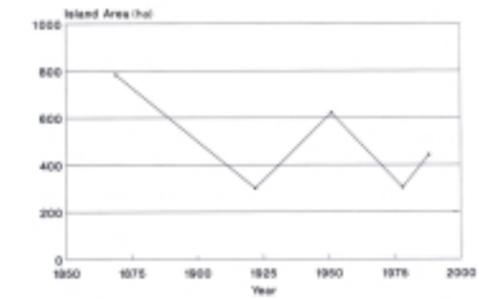


FIGURE 56.—Area changes between 1869 and 1989 of the South Chandeleur Islands.

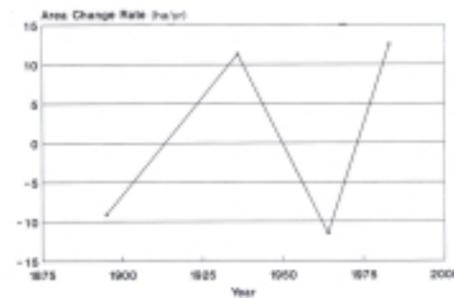


FIGURE 57.—Rate of area change between 1869 and 1989 for South Chandeleur Islands.

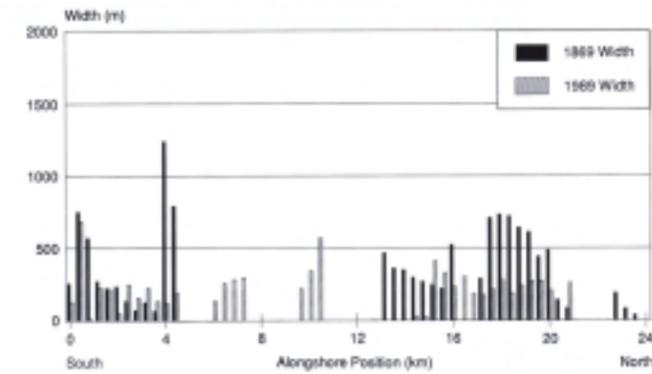


FIGURE 58.—Comparison of the 1869 and 1989 barrier widths along the South Chandeleur Islands shoreline.

TABLE 36.—Area changes for Breton Island from 1869 to 1989

Date	Area (ha)	Change (ha)	% Change	Rate (ha/yr)	Projected Date of Disappearance
1869	332				
1922	271	-61	-18%	-1.2	2091
1922	271				
1951	291	20	7%	0.7	N.A.
1951	291				
1978	141	-150	-52%	-5.4	2004
1978	141				
1989	164	23	16%	2.2	N.A.
1869	222				
1989	164	-169	-51%	-1.4	2106

TABLE 37.—Area changes of the Grand Gosier and Curlew islands from 1869 to 1989

Date	Area (ha)	Change (ha)	% Change	Rate (ha/yr)	Projected Date of Disappearance
1869	453				
1922	29	-424	-94%	-8.0	1926
1922	29				
1951	330	301	1,038%	10.4	N.A.
1951	330				
1978	162	-168	-51%	-6.0	2005
1978	162				
1989	277	115	71%	11.1	N.A.
1869	453				
1989	277	-176	-39%	-1.5	2174

TABLE 38.—Area changes of South Chandeleur Islands from 1869 to 1989

Date	Area (ha)	Change (ha)	% Change	Rate (ha/yr)	Projected Date of Disappearance
1869	784				
1922	300	-484	-62%	-9.1	1966
1922	300				
1951	624	324	108%	11.3	N.A.
1951	624				
1978	303	-321	-51%	-11.5	2003
1978	303				
1989	441	138	46%	13.3	N.A.
1869	784				
1989	441	-343	-44%	-2.9	2199

North Chandeleur Islands-1855 to 1989

Morphology

The North Chandeleur Islands are dominated by a large, arcuate-shaped barrier island that protects three groups of smaller, irregular-shaped islands that lie to the west. In 1855, Chandeleur Island was a fairly continuous barrier island except for breaches along the north-central portion of the shoreline (1855 map). One of the major breaches was known as Schooners Pass; its name indicates how the pass was utilized at the time. At the northern end lies Hewes Point, a large recurved spit complex, and the terminus of longshore sediment transport for the northern half of the barrier island arc. The gulf shoreline forms a smooth arc, but the bay shoreline is crenulate and dominated by washover fans and ebb-tidal deltas. In addition, two other prominent morphological features along the bay shoreline include Redfish Point and Monkey Bayou, interpreted as possible relict distributary systems of the St. Bernard delta. In 1922, several breaches along the north central island shoreline closed, except for three or four, the most prominent of which is still Schooners Pass (1922 map). At this point, the island arc was narrowest at both ends and widest in the central portion. Since then the southern end also has developed some surge channels. A detailed description of surge channels and other related storm impact features is provided by Boothroyd and others (1985). The back-barrier islands (North, New Harbor, and Freeman islands) are moving and deteriorating, especially Freeman Islands, which consist predominately of reworked oyster shells and are therefore, highly mobile.

By 1951, Schooners Pass had closed, but to the north an unnamed inlet remained opened (1951 map). The southern tip of the arc became detached to form Stake Island. Chandeleur Island suffered a devastating hurricane impact by Camille in 1969, which fragmented the arc into numerous smaller islands. However, by 1978, the arc had recovered, and all breaches healed. To the south, Stake and Palos islands disappeared, and the back-barrier islands underwent a major contraction. The 1988 map shows that Chandeleur Island has maintained its overall arcuate shape, smooth gulf shoreline, and highly irregular bay shoreline. Although the back-barrier islands remained, their shapes were very different and sizes greatly reduced.

Shoreline Movement

Comparisons of shoreline position along the North Chandeleur Islands are made for the periods 1855 vs. 1922, 1922 vs. 1951, 1951 vs. 1978, 1978 vs. 1989, and 1855 vs. 1989. Shoreline change is presented in terms of direction, magnitude, and rate of change, as well as island width. These were obtained from 172 shore-normal transects along the gulf and bay shorelines (transects map, tables 39, 40, 41, 42, and 43).

The average gulfside rate of change between 1855 and 1922 was -5.3 m/yr (table 43). This average rate slightly increased to -5.6 m/yr between 1922 and 1951 and increased nearly twofold to -10.0 m/yr between 1951 and 1978 (fig. 59). This doubling of the gulfside rate of change between 1951 and 1978 includes the impact of Hurricane Camille, a category 5 hurricane that made landfall in 1969 at Pass Christian, Miss., after crossing the Chandeleur Islands (Neumann and others, 1985). This large storm severely weakened the overall morphological structure of the Chandeleur Island system, making the arc more susceptible to subsequent storm events. For the period 1978 to 1989, the high average rate of gulfside movement was maintained and even increased to -12.2 m/yr (fig. 59). Contributing to this high rate of shoreline retreat were the impacts of Hurricane Frederic (1979) and Hurricanes Elena and Juan (1985) (Neumann and others, 1985; Case, 1986).

The bay shoreline also was migrating landward. For the period between 1855 and 1922, the average rate of change was 2.2 m/yr (fig. 60, table 41). This average rate increased over twofold to 5.4 m/yr between 1922 and 1951 but decreased to 3.3 m/yr for the period 1951 through 1978. Between 1978 and 1989, the average rate increased to 5.3 m/yr (fig. 60). For the past 134 years, the bay shoreline migrated landward primarily in response to washover deposition associated with extratropical and tropical storms.

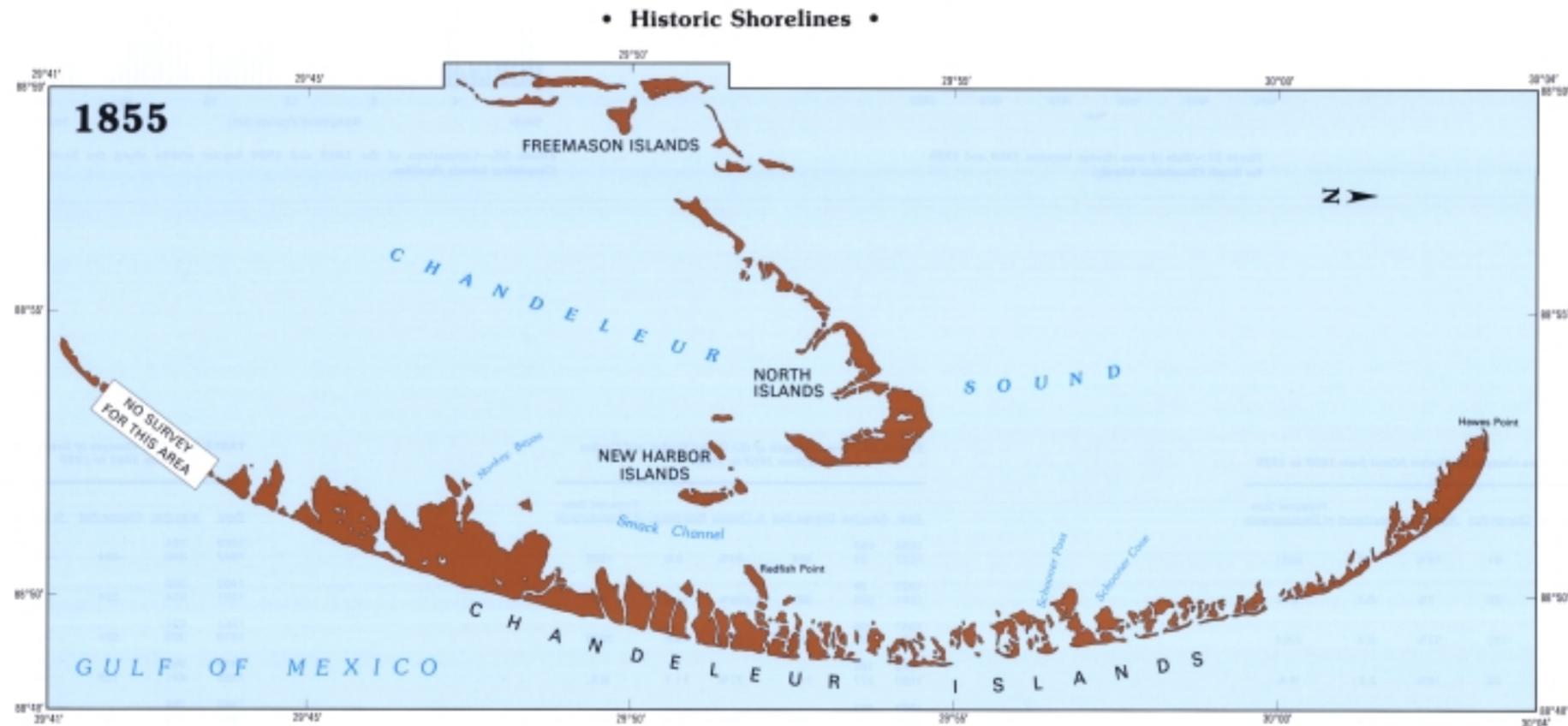
The 1855 vs. 1989 map illustrates land loss for the North Chandeleur Islands and presents a quantitative summary of changes along the gulf and bay shorelines. The rate of change between 1855 and 1989 along the gulf shoreline ranged from -0.2 to -17.6 m/yr, with an average change rate of -6.5 m/yr (table 43). The rate of bayside change for the same period ranged between 15.0 and -2.0 m/yr with an average change rate of 2.9 m/yr (table 41). The gulf and bay shorelines are rapidly migrating

landward, but the gulf shoreline is migrating twice as fast (-6.5 m/yr vs. 2.9 m/yr), causing net deterioration of the islands.

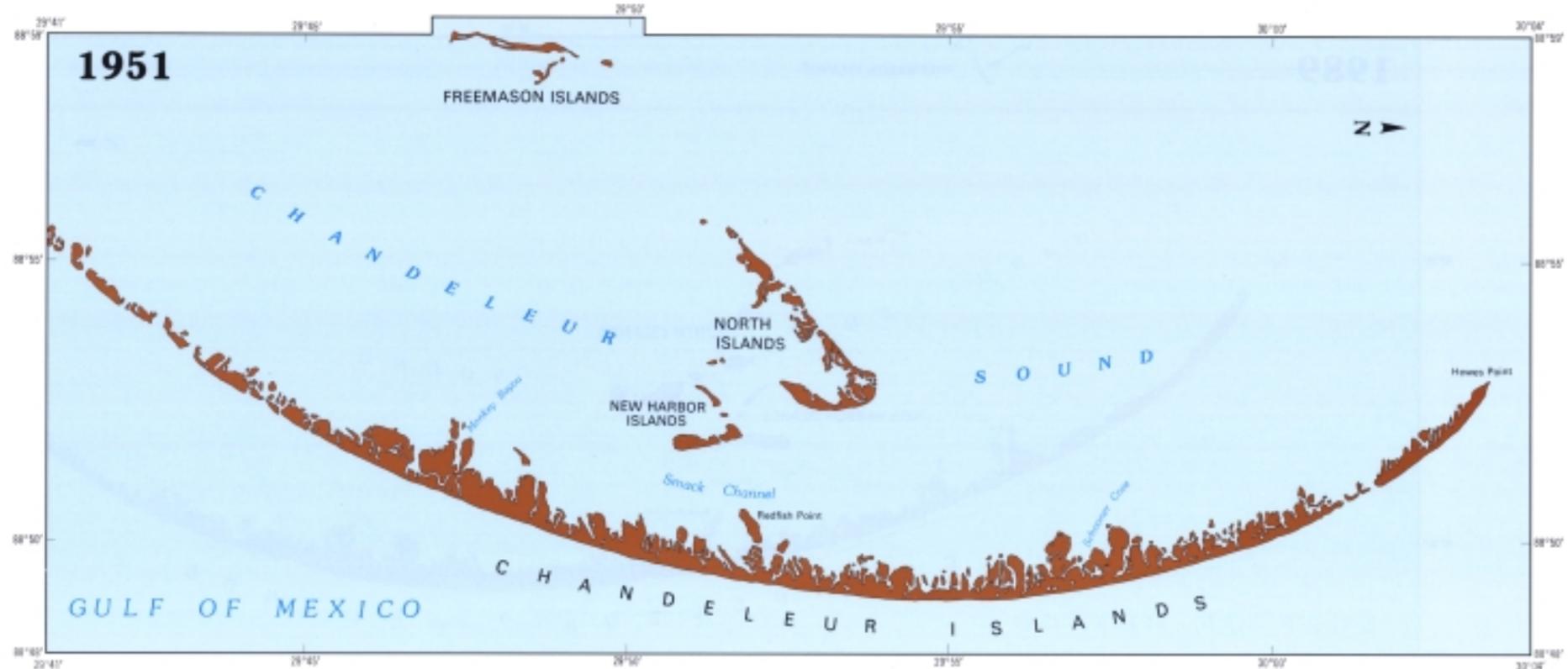
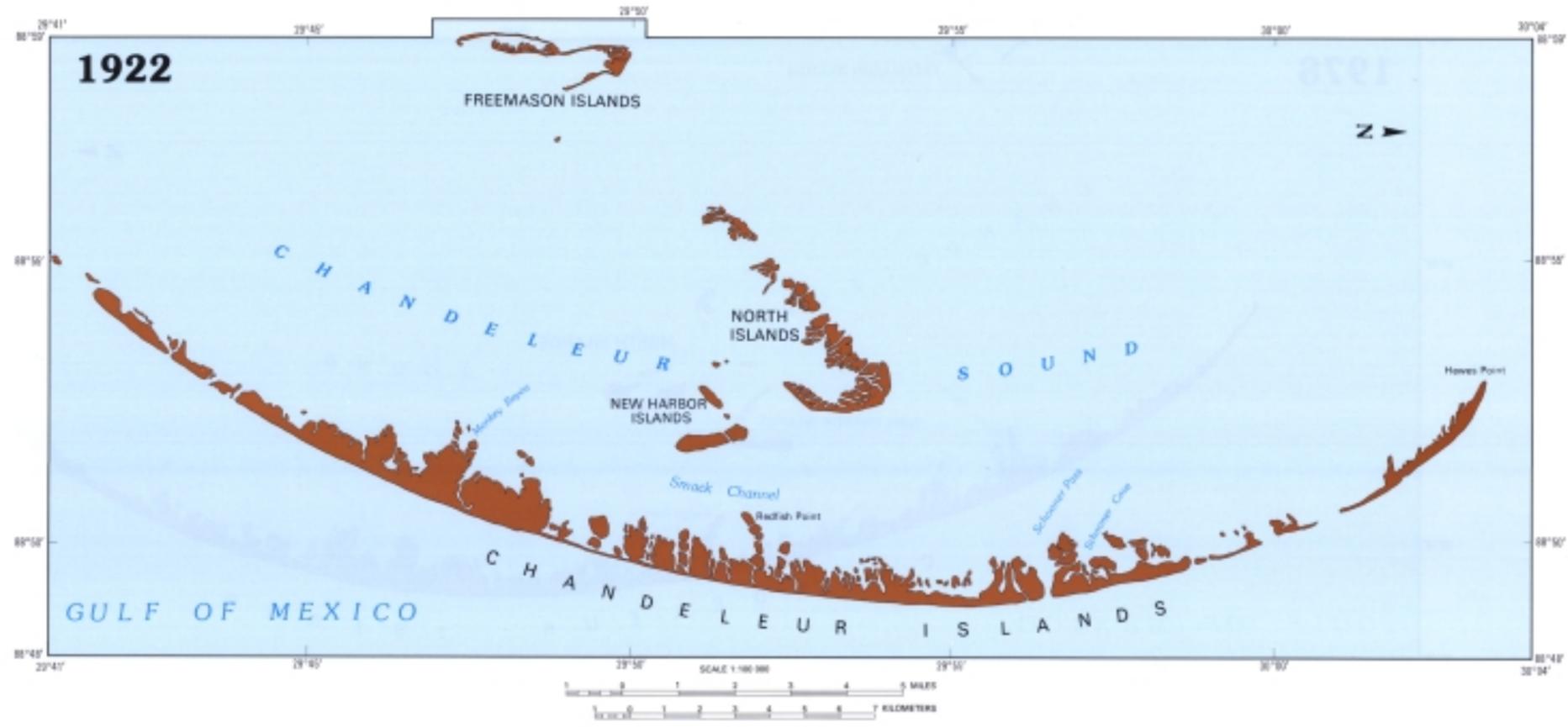
Area and Width Change

To better understand area changes, comparisons are made to general trends in barrier width (tables 42 and 44). In 1855, Chandeleur Island contained 2,763 ha of land with an average width of 941 m. By 1922, total area further decreased to 2,485 ha, while average width decreased to 670 m. During the period 1855 to 1922, the rate of area change was -4.1 ha/yr (fig. 61). However, by 1951, the island arc increased in area to 2,588 ha. This was consistent with an increase in average width to 678 m. For the period 1922 to 1951, the average rate of area change was 3.6 ha/yr, indicating a reverse from land loss to land gain. Not surprisingly, Chandeleur Island lost the most area between 1951 and 1978, which coincides with the impact of Hurricane Camille in 1969. The island arc lost 31 percent, or 792 ha, of its land area at a rate of -28.5 ha/yr. Correspondingly, average barrier width decreased to 506 m. By 1989, both area and width only slightly decreased to 1,749 ha and 475 m, respectively, and the rate of area change slowed to -4.5 ha/yr (fig. 61).

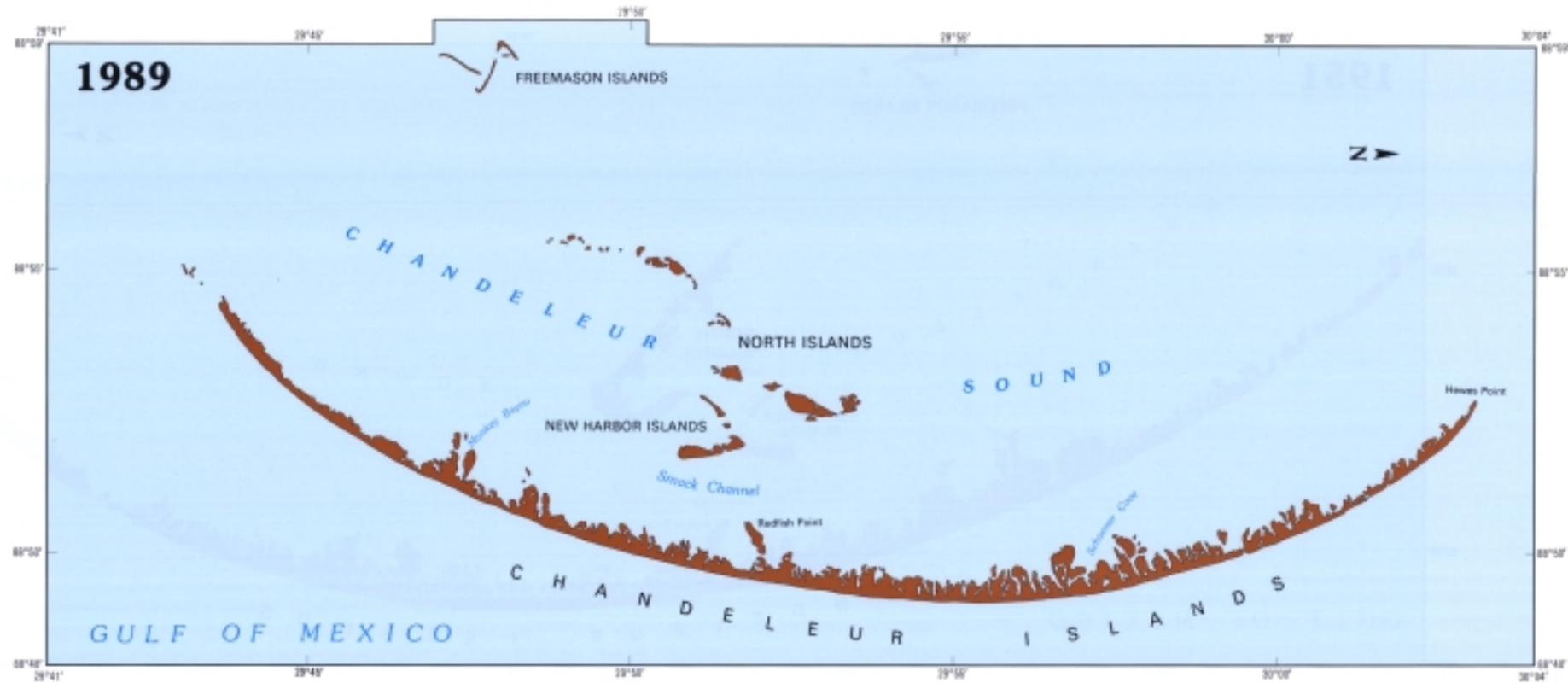
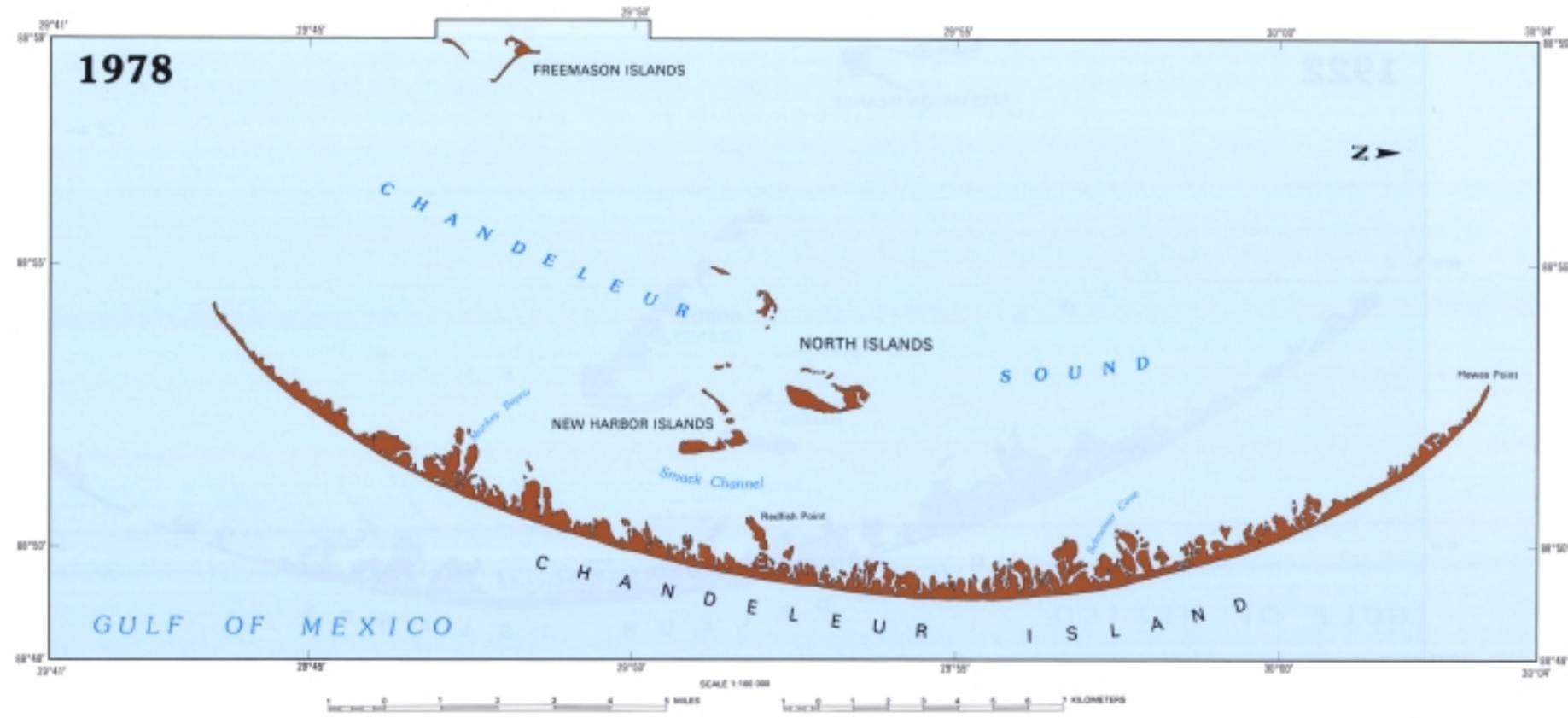
Over the last 134 years, Chandeleur Island has experienced a decrease in area from 2,763 to 1,749 ha (fig. 62, table 44), at an average loss rate of 7.6 ha/yr. This represents a 37 percent decrease in island area, most of which occurred between 1951 and 1978. Compared with other barrier islands along the Louisiana coast, the area of Chandeleur Island has decreased at a slower rate. Between 1855 and 1989, both the gulf and bay shorelines migrated landward. However, the gulf shoreline migrated landward more than twice as fast as the bay shoreline (-6.5 m/yr vs. 2.9 m/yr, respectively), causing island width to narrow (fig. 63, table 42). The barrier island decreased in average width from 941 m in 1855 to 475 m in 1989, representing an average narrowing rate of 3.5 m/yr for the past 134 years (fig. 63). Barrier widths for 1855 and 1989 are shown in figure 64. Meanwhile, area changes decreased for North and Freeman islands but remained stable for New Harbor Islands (tables 45, 46, and 47).



North Chandeleur Islands



North Chandeleur Islands



North Chandeleur Islands

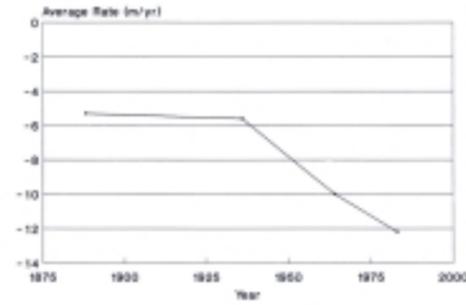


FIGURE 59.—Average gulfside rate of change between 1855 and 1989 along Chandeleur Island.

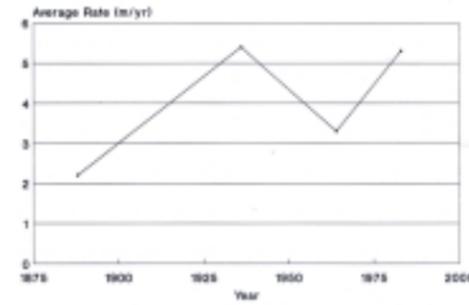


FIGURE 60.—Average bayside rate of change between 1855 and 1989 along Chandeleur Island.

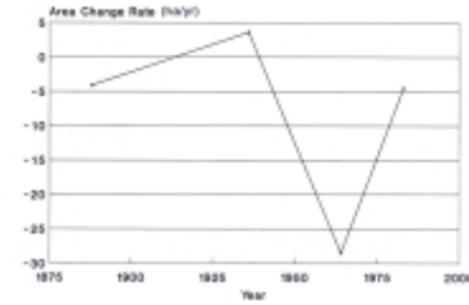


FIGURE 61.—Rate of area change between 1855 and 1989 of Chandeleur Island.

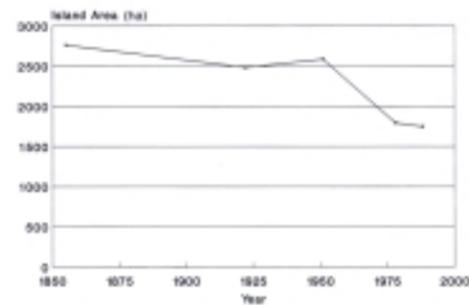


FIGURE 62.—Area changes between 1855 and 1989 of Chandeleur Island.

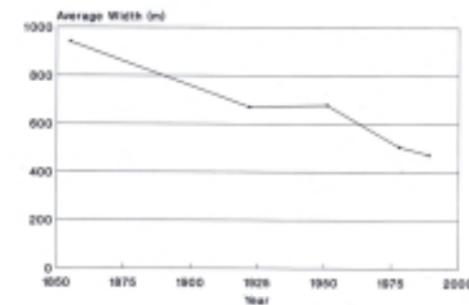


FIGURE 63.—Average barrier width between 1855 and 1989 along Chandeleur Island.

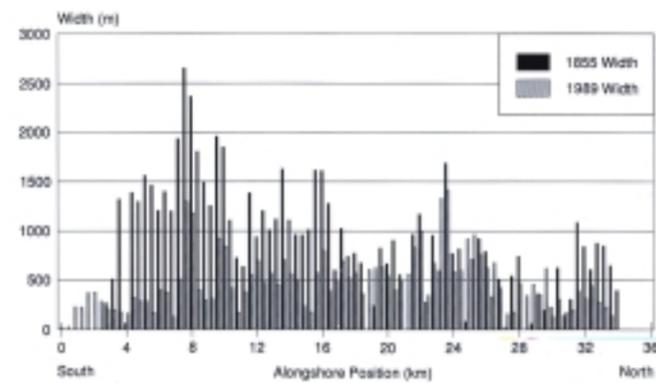
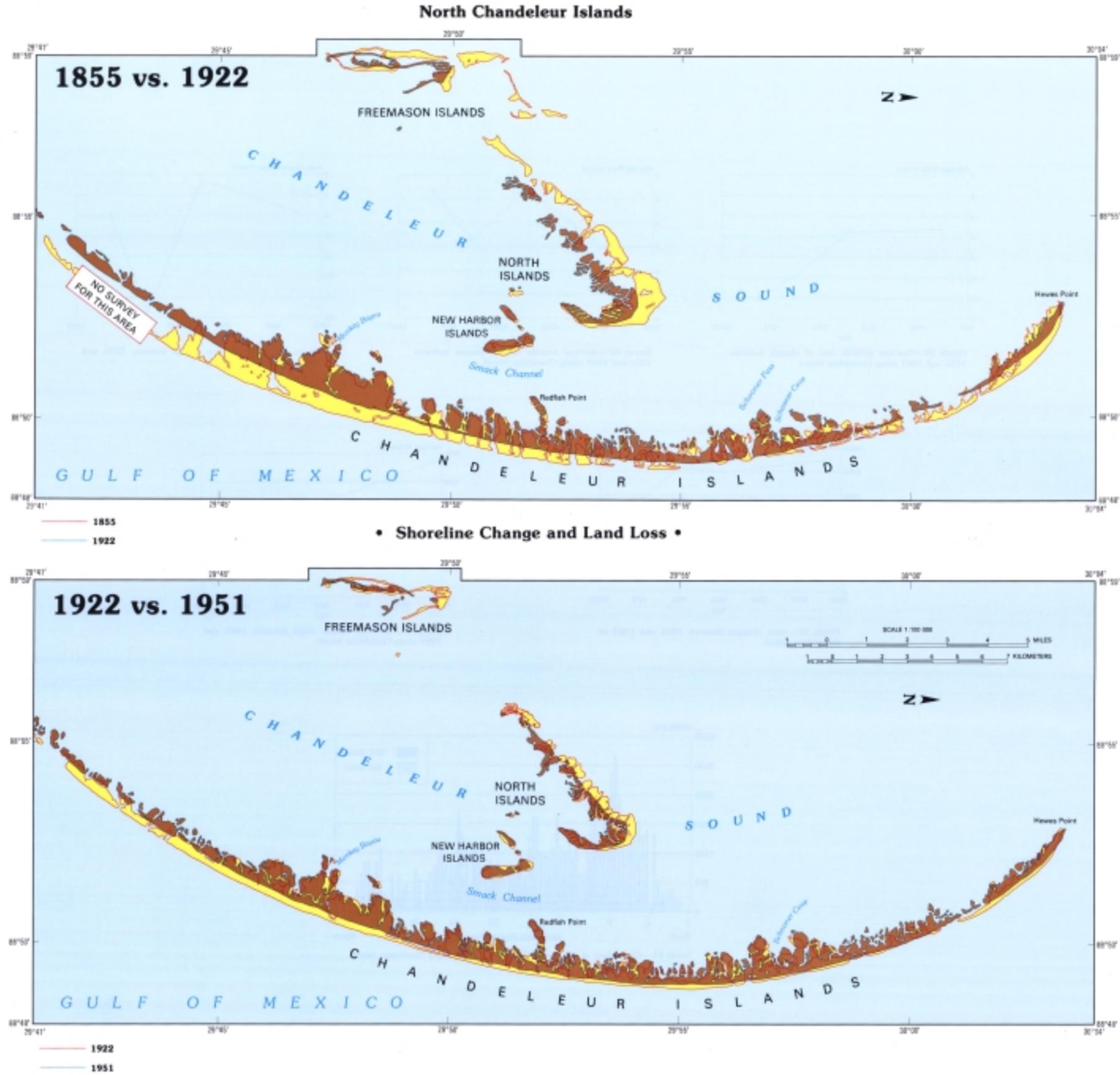


FIGURE 64.—Comparison of 1855 and 1989 barrier widths along Chandeleur Island.



North Chandeleur Islands

